

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of using a hydrogen containing gas as a fuel, a component of a fuel, a fuel additive or an additive to air for mixing with a fuel for use in a compression engine characterised in that the hydrogen gas or hydrogen containing gas is produced by a hydrogen generator in which the hydrogen containing gas also contains products from the hydrogen generation process used to generate the hydrogen gas, including the steps of producing the hydrogen containing gas blend or mix by the hydrogen generator, introducing the gas blend or mix to a compression engine as one component of the fuel and combusting the fuel to produce power in the engine, wherein the relative amounts of the components of the gas blend or mix including the amount of hydrogen and non hydrogen components are selected in accordance with the requirements of hydrogen assisted combustion of the engine.
2. An apparatus for producing a hydrogen containing gas, blend or mix comprising a hydrogen gas generator or a mixer characterised in that the hydrogen gas, hydrogen containing gas, mixture or blend is produced by the hydrogen gas generator together with other materials such that the relative amounts of the hydrogen and other materials in the gas blend or mix are in preselected or predetermined amounts with respect to each other in accordance with the requirement of hydrogen assisted combustion of the engine to which the gas blend or mix is introduced and mixing the components in the mixer prior to combustion.
3. A method of operating a hydrogen generated apparatus to produce a hydrogen containing gas, blend or mixture characterised in that the hydrogen and at least one other component suitable for use as a fuel, a fuel

component, a fuel additive or similar are produced by a hydrogen generator wherein the operating parameters of the hydrogen generating apparatus are adjusted to provide preselected or predetermined composition of the gas blend or mixture in which the respective amounts of the hydrogen or other component or components are in accordance with the requirements of an engine to which the gas blend or mixture is introduced in order to facilitate hydrogen assisted combustion of the engine thereby increasing the efficiency and/or performance of the engine.

4. A fuel for hydrogen assisted combustion of an engine characterised in that hydrogen is produced by a hydrogen generator in combination with one or more other material or material in which the relative amounts of the hydrogen to the other material or materials is selected in accordance with the requirements of the engine such that the other components are not removed from the gas prior to combustion.

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5. A hydrogen containing gas blend or mix characterised in that the gas blend or mix contains one or more components in addition to hydrogen in which the relative amounts of the hydrogen to the other component or components is in accordance with the requirements of hydrogen assisted combustion within an engine to which the gas blend or mix is introduced.

6. A hydrogen containing gas mix or blend produced by a hydrogen blend generator characterised in that the non hydrogen components of the gas produced by the hydrogen generator do not require removal prior to combustion of the gas in a compression engine using nitrogen assisted combustion.

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7. A method or apparatus according to any preceding claim characterised in that the hydrogen generator is an

electrolysis apparatus, a fuel cell, a fuel processor, a reformer, a cold fusion apparatus or the like or other apparatus for producing hydrogen.

5 8. A method or apparatus according to any preceding claim characterised in that the fuel cell is a proton exchange fuel cell, a solid oxide fuel cell, an alkaline fuel cell, a direct methanol fuel cell, a molten carbonate fuel cell, a phosphoric acid fuel cell or a regenerative fuel cell.

10 9. A method or apparatus according to any preceding claim in which the hydrogen generator is a reformer in which steam is used to heat a fuel as it passes over a catalyst provided in the hydrogen generator.

15 10. A method or apparatus according to any preceding claim characterised in that the fuel and steam are cracked by passage through the hydrogen generator to form a hydrogen gas.

20 11. A method or apparatus according to any preceding claim characterised in that the reformer reforms a hydrocarbon fuel to the hydrogen gas with the aid of steam.

25 12. A method or apparatus according to any preceding claim characterised in that the hydrogen generator produces hydrogen in combination with at least one or more of oxygen, nitrogen, water, ethanol, carbon dioxide, carbon monoxide, hydrocarbons, methanol, methane or the like.

30 13. A method or apparatus according to any preceding claim characterised in that the hydrocarbon material produced in the hydrogen generator is a paraffin or paraffin like hydrocarbon containing saturated bonds.

14. A method or apparatus according to any preceding claim characterised in that the hydrocarbon is a C₁-C₂₀ hydrocarbon, preferably a C₂-C₁₂ hydrocarbon, more preferably a C₄-C₁₀ hydrocarbon and more preferably a C₈ hydrocarbon, including mixtures and combinations of at least one or more such materials.
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15. A method or apparatus according to any preceding claim characterised in that the methanol, methane or similar materials produced in combination with the hydrogen gas are produced from a fuel material such as diesel, petrol, canola oil or the like.
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16. A method or apparatus according to any preceding claim characterised in that the hydrogen gas blend or mix produced by the hydrogen generator contains from about 0-50% by volume of hydrogen, preferably 30-40% by volume and preferably 35-48% by volume hydrogen.
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17. A method or apparatus according to any preceding claim characterised in that the gas blend or mix includes from about 0-25% by volume of carbon monoxide, preferably 3-5% by volume, more preferably 4-5% by volume carbon monoxide.
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18. A method or apparatus according to any preceding claim characterised in that the amount of hydrocarbon material contained in the gas mix or blend is from 0-5% by volume, typically 1-4% by volume, preferably 2-3% by volume.
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19. A method or apparatus according to any preceding claim characterised in that the amount of carbon dioxide contained in the gas mix or blend is from 0-25% by volume, preferably 5-15% by volume and more preferably 3-10% by volume.
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20. A method or apparatus according to any preceding claim characterised in that the gas blend or mix contains the balance of nitrogen.

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21. A method or apparatus according to any preceding claim characterised in that the ratio of individual components in the gas blend or mix is predetermined or preselected.

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22. A method or apparatus according to any preceding claim characterised in that operation of the hydrogen generator is adjusted to produce a desired ratio of hydrogen to other components in the gas mix or blend formed by the hydrogen generator.

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23. A method or apparatus according to any preceding claim characterised in that operation of the hydrogen generator is adjusted by altering parameters such as the composition of the materials introduced to the hydrogen generator, the velocities of gases to the various components, the temperature of operation of the hydrogen generator, the pressure of the hydrogen generator, the velocity of gas being passed through the generator, the catalyst being used in the generator, the amount of exposure to the reactor to the catalyst, the type of hydrogen generator used or the like.

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24. A method or apparatus according to any preceding claim characterised in that the hydrogen generator in the form of a reformer is operated at a temperature of from 100°C-1000°C, preferably from 200°C-900°C, more preferably from 220°C-800°C.

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35 25. A method or apparatus according to any preceding claim characterised in that the hydrogen generator is operated at a pressure of from about 1-5 bar, preferably

from about 1-3 bar and more preferably from about 2 bar.

26. A method or apparatus according to any preceding claim characterised in that the catalyst used in the 5 hydrogen generator is nickel, platinum or materials containing nickel or platinum or combinations thereof.
27. A method or apparatus according to any preceding claim characterised in that the gas mix or blend is added 10 directly to the engine or indirectly to the engine.
28. A method or apparatus according to any preceding claim characterised in that the gas mix or blend is added to the engine via a further component in which the further 15 component is a mixing chamber.
29. A method or apparatus according to any preceding claim characterised in that the compression engine is a diesel engine.
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30. A method or apparatus according to any preceding claim characterised in that the system includes one or more heat exchangers.
- 25 31. A method or apparatus according to any preceding claim characterised in that the gas blend or mixture is added separately to the engine or mixer or in combination with one or more other components of the fuel for the engine.
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32. An apparatus or method in accordance with any preceding claim in which the fuel for the compression engine is introduced to the engine separately from the components for hydrogen assisted combustion.

33. A method or apparatus substantially as hereinbefore described with reference to the accompanying drawings.